Statement of Work

I. Title: EPA Positive Matrix Factorization-Human Exposure (PMFex) Version 1.1
Contractor Name: ICF
Contract #: EP-W-12-010
WA #: 3-40

II. Work Assignment Manager (WAM):

WAM Name: Janet Burke
U.S. Environmental Protection Agency
Office of Research and Development (ORD)
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III. Background:

The National Exposure Research Laboratory (NERL) within EPA's Office of Research and Development develops receptor modeling tools for identifying air pollution sources and quantifying their contributions to human exposure using measurement data collected as part of human exposure field studies. One of these receptor modeling tools is the EPA Positive Matrix Factorization-Human Exposure (PMFex) model that provides source profiles and contributions based only on chemically speciated sample data from multiple environments including community, residential outdoor, residential indoor, and personal measurements. The PMFex graphical user interface (GUI) was previously developed by Sonoma Technology, Inc. (EPA Contract Number EP-D-09-097), and allows for reading of input data files, selection of model run options, and display of model results from the Multilinear Engine (ME) receptor model (Hopke et al. 2003). PMFex version 1.0 was developed following the Quality Assurance Project Plan (QAPP) for Developing a Graphical User Interface for Positive Matrix Factorization Human Exposure (PMFex) Receptor Model (09/25/2013, Sonoma Technology Inc.). The final deliverable provided to EPA included an installation package for installing the PMFex version 1.0 executable and required files on a computer with the Windows 7 operating system.

A number of software errors and GUI changes have been identified based on EPA testing of PMFex version 1.0 with three different input datasets. The datasets used for testing include: (1) residential indoor, outdoor and community data from the Near-Road Exposures and Effects of Urban Air Pollutants Study (NEXUS) (Vette et al. 2013), (2) personal, residential indoor,

outdoor and community data from the Research Triangle Park (RTP) PM Panel Study (Zhao et al. 2006), and (3) simulated personal, residential indoor and community data generated from the Stochastic Human Exposure and Dose Simulation (SHEDS) model (Burke et al. 2001).

For this work assignment, the contractor shall modify EPA PMFex version 1.0 to address these errors and GUI changes using the test datasets to identify and correct errors, and provide version 1.1 of the PMFex model executable and new installation package.

References:

Burke, J. M., Zufall, M. J., & Ozkaynak, H. (2001). A population exposure model for particulate matter: case study results for PM2. 5 in Philadelphia, PA. *Journal of exposure analysis and environmental epidemiology*, *11*(6), 470-489.

Hopke, P.K., Ramadan, Z., Paatero, P., Norris, G.A., Landis, M.S., Williams, R.W., Lewis, C.W. (2003). Receptor modeling of ambient and personal exposure samples: 1998 Baltimore Particulate Matter Epidemiology-Exposure Study. *Atmospheric Environment.* 37: 3289 - 3302.

Vette, A, Burke, J, Norris, G, Landis, M, Batterman, S, Breen, M, Isakov, V, Gilmour, I, Lewis, T, Kamal, A, Hammond, D, Vedantham, R, Bereznicki, S, Tian, N, Croghan, C (2013) The Near-Road Exposures and Effects of Urban Air Pollutants Study (NEXUS): Study Design and Methods. *Science of the Total Environment*, 448: 38-47.

Zhao, W., Hopke, P.K., Norris, G.A., Williams, R., Paatero, P. (2006) Source apportionment and analysis on ambient and personal exposure with a combined receptor model and an adaptive blank estimation strategy. *Atmospheric Environment.* 40: 3788 - 3801.

IV. Description and Tasks:

Task #1: Work Plan

The Contractor shall develop a new work plan. The Contractor shall hold conference calls with the WAM on at least a biweekly basis after approval of the work plan to plan and review progress of this WA.

Task #2: Refinement and testing of EPA PMFex

The contractor shall modify the EPA PMFex version 1.0 model to address the following list of software errors and graphical user interface (GUI) changes.

Software errors:

- Error/model crash at end of Base Model Run using input data files containing only Indoor, Personal and Community (no Outdoor) that is related to plotting of time series output in the GUI
- If Base Model Run is completed but error/model crash occurs when displaying results in the GUI, the model needs to write all output files to the Output directory (currently no output files are created when error occurs)
- Error/model crash when reload a saved configuration file (.cfg) without an air exchange rate data input file on the Data Files tab that is related to an air exchange rate input filename being inserted in the GUI and the need to clear previous files for the air

exchange rate data input file field so it is not save in the .cfg file (also check for same errors with Supplemental input file)
- Error/model crash when load a specific air exchange rate data input file (SHEDS simulated data) on Data Files tab

GUI modifications:

- Stacked graphs for Profiles/Contributions: add Indoor Profiles to the Outdoor Profiles, as done for Factor Contributions stack graphs (stack all graphs)
- Factor Fingerprints plot: add separate plots by environment with tabs at bottom right, so plot is the same as for ID Bar Chart where Outdoor displays only for outdoor, Indoor includes both Outdoor and Indoor, etc.

The contractor shall test the revised PMFex model software using three different input data sets listed in the table below. EPA will provide the test data sets to the contractor following award of the work assignment. Each of the test data sets have different combinations of sample data for the environments. The contractor shall use the test data sets to identify the sections of code that need to be revised based on the software errors and demonstrate that the software changes have addressed the errors. The contractor shall also test the revised PMFex model software with and without using residential air exchange rate input data files, and with supplementary input data files when available for the test data set. The contractor shall provide a written summary of the testing results in a Microsoft Word document.

Test Data Set		Type of Data
1	Near-Road Exposures and Effects of Urban Air Pollutants Study (NEXUS) data	Community, Outdoor, and Indoor Residential air exchange rates Supplementary data
2	Research Triangle Park (RTP) PM Panel Study data	Community, Outdoor, Indoor, and Personal Residential air exchange rates
3	Stochastic Human Exposure and Dose Simulation (SHEDS) simulated data (Burke et al. 2001)	Community, Indoor, and Personal Residential air exchange rates

Task #3: PMFex 1.1 executable, program files, and installation package

The contractor shall provide the revised PMFex model as EPA PMFex version 1.1 and provide the standalone executable, program files, and installation package.

V. QA Requirements:

The contractor shall follow the Quality Assurance Project Plan (QAPP) for Developing a Graphical User Interface for Positive Matrix Factorization Human Exposure (PMFex) Receptor Model (09/25/2013, Sonoma Technology Inc.). The contractor shall amend the QAPP with an

updated signature page and distribution list as needed for this work assignment. The revised QAPP shall be submitted within 20 days after the effective date of the WA, and work on the project shall not begin until the revised QAPP has been approved by the WAM and HEASD QA Manager.

VI. Deliverables:

The Contractor shall adhere to the following schedule:

Task	Deliverable	Due Date
1	Work Plan and Revised QAPP	20 days after effective date of WA
2	Revised EPA PMFex Testing Report	4 months after effective date of WA
3	EPA PMFex version 1.1 standalone executable, program files, and installation package	4 months after effective date of WA

VII. Reporting Requirements:

The Contractor shall provide monthly progress reports in accordance with the terms of the contract. The Contractor shall submit work products in electronic as well as hard copy form. In addition, the Contractor shall deliver to the WAM each draft and final report in electronic format that is readable by windows-based word-processing (Microsoft Word 2003), graphics (Microsoft PowerPoint 2003), spreadsheet (Excel 2003), and database (Access 2003) programs. The Contractor shall also provide electronic copies of reports in PDF format.